WHAT IS CLAIMED IS:

1. A thermal barrier coating, which comprises:

A. a zirconia-containing upper layer wherein the zirconia is stabilized in the cubic crystalline phase, and which comprises:

1. at least about 50 mole % zirconia; and

2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising:

a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the upper layer; and

b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the upper layer; and

3. one or more of a third metal oxide selected from the group consisting of:

a. hafnia in an amount from about 0.5 to about 40 mole % of the upper layer; and

b. tantala in an amount of from about 0.5 to about 10 mole % of the upper layer; and

B. a zirconia-containing lower layer wherein the zirconia is stabilized in the tetragonal crystalline phase, and which comprises:

1. at least about 80 mole % zirconia;

2. a stabilizing amount up to about 10 mole % of a stabilizer component, which comprises:

a. a first metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of from about 1.5 to about 6 mole %; and

b. a second metal oxide selected from the group consisting of lanthana, neodymia, ytterbia and mixtures thereof in an amount

of from about 0.5 to about 8.5 mole %.

2. The coating of claim 1 wherein the upper layer comprises from about 50 to about 90 mole % zirconia, from about 10 to about 40 mole % first metal oxide and about 2 mole % or less of the second metal oxide, and wherein the lower layer comprises from about 86 to about 97% zirconia and from about 3 to about 10 mole % stabilizer component.

3. The coating of claim 2 wherein the upper layer comprises from about 60 to about 85 mole % zirconia, from about 10 to about 30 mole % first metal oxide and about 2 mole % or less of the second metal oxide, and wherein the lower layer comprises from about 88 to about 95% zirconia and from about 5 to about 8 mole % stabilizer component.

4. The coating of claim 3 wherein the first metal oxide of the stabilizer component of the upper layer is selected from the group consisting of ytterbia, mixtures of ytterbia and neodymia and mixtures of ytterbia and lanthana, and wherein the second metal oxide of the stabilizer component of the lower layer is selected from the group consisting of lanthana, ytterbia and mixtures thereof.

5. The coating of claim 4 wherein the upper layer comprises from about 5 to about 25 mole % hafnia and from about 2 to about 8 mole % tantala and wherein the lower layer further comprises hafnia in an amount from about 1.5 to about 5 mole %.

6. The coating of claim 2 wherein the upper layer comprises from about 60 to about 95% of the thickness and wherein the lower layer comprises from about 5 to about 40% of the thickness.

7. The coating of claim 6 wherein the upper layer comprises from about 70 to about 85% of the thickness and wherein the lower layer comprises from about 15 to about 30% of the thickness.

8. A thermally protected article, which comprises:

I. a substrate;

II. a bond coat layer adjacent to and overlaying the substrate; and

III. a thermal barrier coating adjacent to and overlaying the bond coat layer, the thermal barrier coating comprising:

A. a zirconia-containing upper layer wherein the zirconia is stabilized in the cubic crystalline phase, and which comprises:

1. at least about 50 mole % zirconia; and

2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising:

a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the upper layer;

b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the upper layer; and

3. one or more of a third metal oxide selected from the group consisting of:

a. hafnia in an amount from about 0.5 to about 40 mole % of the upper layer; and

b. tantala in an amount of from about 0.5 to about 10 mole % of the upper layer; and

B. a zirconia-containing lower layer adjacent to and overlaying the bond coat layer, wherein the zirconia is stabilized in the tetragonal crystalline phase, and which comprises:

1. at least about 80 mole % zirconia; and

2. a stabilizing amount up to about 10 mole % of a stabilizer component, which comprises:

a. a first metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of from about 1.5 to about 6 mole %; and

b. a second metal oxide selected from the group consisting of lanthana, neodymia, ytterbia and mixtures thereof in an amount of from about 0.5 to about 8.5 mole %.

9. The article of claim 8 wherein the substrate is a metal substrate and wherein the thermal barrier coating has a thickness of from about 1 to about 100 mils.

10. The article of claim 9 wherein the upper layer comprises from about 60 to about 95% of the thickness of the thermal barrier coating and wherein the lower layer comprises from about 5 to about 40% of the thickness of the thermal barrier coating.

11. The article of claim 10 wherein the upper layer comprises from about 70 to about 85% of the thickness of the thermal barrier coating and wherein the lower layer comprises from about 15 to about 30% of the thickness of the thermal barrier coating.

12. The article of claim 10 wherein the thermal barrier coating has a strain-tolerant columnar structure.

13. The article of claim 12 wherein the upper layer comprises from about 50 to about 90 mole % zirconia, from about 10 to about 40 mole % first metal oxide and about 2 mole % or less of the second metal oxide, and wherein the lower layer comprises from about 86 to about 97% zirconia and from about 3 to about 10 mole % stabilizer component.

14. The article of claim 13 wherein the upper layer comprises from about 60 to about 85 mole % zirconia, from about 10 to about 30 mole % first metal oxide and about 2 mole % or less of the second metal oxide, and wherein the lower layer comprises from about 88 to about 95% zirconia and from about 5 to about 8 mole % stabilizer component.

15. The article of claim 14 wherein the first metal oxide of the stabilizer component of the upper layer is selected from the group consisting of ytterbia, mixtures of ytterbia and neodymia and mixtures of ytterbia and lanthana, and wherein the second metal oxide of the stabilizer component of the lower is selected from the group consisting of

lanthana, ytterbia and mixtures thereof.

16. The article of claim 15 wherein the upper layer comprises from about 5 to about 25 mole % hafnia and from about 2 to about 8 mole % tantala and wherein the lower layer further comprises hafnia in an amount from about 1.5 to about 5 mole %.

17. The article of claim 12 which is a turbine engine component.

18. The article of claim 17 which is a turbine shroud and wherein the thermal barrier coating has a thickness of from about 30 to about 70 mils.

19. The article of claim 17 which is a turbine airfoil and wherein the thermal barrier coating has a thickness of from about 3 to about 15 mils.

20. A method for preparing thermal barrier coating on a metal substrate having a bond coat layer, the method comprising the step of:

A. forming a zirconia-containing lower layer wherein the zirconia is stabilized in the tetragonal crystalline phase by depositing on the a bond coat layer a first zirconia-containing ceramic composition, which comprises:

1. at least about 80 mole % zirconia; and
2. a stabilizing amount up to about 10 mole % of a stabilizer component, which comprises:
   a. a first metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of from about 1.5 to about 6 mole %; and
   b. a second metal oxide selected from the group consisting of lanthana, neodymia, ytterbia and mixtures thereof in an amount of from about 0.5 to about 8.5 mole %; and

B. forming a zirconia-containing upper layer wherein the zirconia is stabilized in the cubic crystalline phase by depositing on the lower layer a second zirconia-containing ceramic composition, which comprises:

1. at least about 50 mole % zirconia; and
2. a stabilizing amount up to about 49 mole % of a stabilizer component comprising:

a. a first metal oxide selected from the group consisting of ytterbia, neodymia, mixtures of ytterbia and neodymia, mixtures of ytterbia and lanthana, mixtures of neodymia and lanthana, and mixtures of ytterbia, neodymia and lanthana in an amount of from about 5 to about 49 mole % of the second composition; and

b. a second metal oxide selected from the group consisting of yttria, calcia, ceria, scandia, magnesia, india and mixtures thereof in an amount of about 4 mole % or less of the second composition; and

3. one or more of a third metal oxide selected from the group consisting of:

a. hafnia in an amount from about 0.5 to about 40 mole % of the second composition; and

b. tantala in an amount of from about 0.5 to about 10 mole % of the second composition.

21. The method of claim 20 wherein the ceramic compositions of the first and second compositions are deposited by physical vapor deposition to form a thermal barrier coating having a strain-tolerant columnar structure.

22. The method of claim 21 wherein the lower layer is formed by depositing a first ceramic composition comprising from about 86 to about 97% zirconia and from about 3 to about 10 mole % stabilizer component and wherein the upper layer is formed by depositing a second ceramic composition comprising from about 50 to about 85 mole % zirconia, from about 10 to about 40 mole % first metal oxide and about 2 mole % or less second metal oxide.

23. The method of claim 22 wherein the lower layer is formed by depositing a first ceramic composition comprising from about 88 to about 95% zirconia and from about 5 to about 8 mole % stabilizer component and wherein the upper layer is formed by depositing a second ceramic composition comprising from about 60 to about 85 mole % zirconia, from about 10 to about 30 mole % first metal oxide and about 2 mole % or less second metal oxide.

24. The method of claim 21 wherein the lower layer is formed so as to comprise from about 5 to about 40% of the thickness of the thermal barrier coating and wherein the upper layer is formed so as to comprise from about 60 to about 95% of the thickness of the thermal barrier coating.

25. The method of claim 21 wherein the lower layer is formed so as to comprise from about 15 to about 30% of the thickness of the thermal barrier coating and wherein the upper layer is formed so as to comprise from about 70 to about 85% of the thickness of the thermal barrier coating.